The antecedents and development of unsafety

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Introduction

The historical development of occupational health and safety management in construction has in part dictated its lexicon. Early focus was on the identification and mitigation of physical risks within the workplace, through the provision of machine guards and controls (Lingard and Rowlinson 2005) which led to prescriptive management approaches that focused on unsafe conditions through mechanistic regulations. Subsequently, as the number of accidents decreased focus shifted onto unsafe acts, through approaches such as behaviour-based safety (Lingard and Rowlinson 2005), goals and feedback programmes, and most recently notions of safety climate and culture have emerged (Choudhry et al 2007).

A consequence of this 'language of safety' is the way it has shaped and even directed safety management thinking and practice (Sherratt 2016). Here the area of focus is that of accident and near-miss reporting , and the legacy of this lexicon can be seen in the construction of unsafe acts or unsafe conditions as a binary either/or situation. However, accidents are often highly complex in reality, and to use such a simplistic dichotomy in reporting and subsequent investigation is likely to limit the learning potential of an incident. Indeed, although 'acts' have come to the fore in terms of management focus, evidence has shown that organisational factors are often critical (Lingard and Rowlinson 2005); whilst Hinze (1996) argued that it is always a combination of physical conditions and worker actions that is the true cause of accidents on sites.

Despite such evidence, unsafe acts and unsafe conditions often remain segregated in practice, reinforced by the lexicon itself. Accident and near miss reporting seeks to categorise one or the other, with no potential for overlap. Academic advances in accident analysis have led to the development of ever more complex approaches, grounded in systems thinking and organisational failure models, yet their utility has been questioned (Hovden et al 2010). Such models are rarely used in practice, and would be challenging to apply to near-miss reporting, which is often large scale in terms of volume, but with relatively little management time available to record, analyse and act upon them.

'Unsafety' can be considered as the condition of being unsafe. While not a common concept in the field of safety science, it is far from new. Hauer (1992) provides an attempt to quantify unsafety with an attempt to understand the effect of interventions on this concept. More recently, Atsuji (2016) provides a much broader consideration of the term when applied to disasters and accidents. Drawing on a large database of 3,956 safety observation reports from a large UK infrastructure construction project the aims of the work presented in this paper are twofold. First is an attempt to explore empirically the consequences of a dualistic approach to unsafety and how acts and conditions combine in practice. The second is to understand the antecedents and precursors of unsafety with the simple premise that knowing how unsafety develops may allow the introduction of focussed interventions.

Context

Unsafe Conditions and Unsafe Acts

Early health and safety management was grounded in the elimination of unsafe working conditions, indeed the earliest UK safety legislation sought to address the mechanistic problems of exposed mill-gearing in the factories of the industrial revolution. Developments in technology brought new hazards and risks into workplaces, and key concerns were to "… find the technical means to safeguard machinery, to stop explosions and to prevent structures from collapsing" (Hollnagel 2014:24).

Within the UK construction industry, unsafe conditions are often addressed through rigorous legislation, such as that found within Part 4 of the Construction (Design and Management) Regulations 2015, which sets out amongst other things how stability of structures must be maintained, how excavations must be managed and how good order can be kept on sites.

Alongside such unsafe conditions relating to the work space can often be found the concept of unsafe acts, relating to the behaviour of the people who work there. This is not a new concept – processes of human reliability assessment were developed in the 1980s to fit alongside the already established risk assessment approach to safety management. As Hollnagel (2014:30) states, "the idea that human error could be used to explain the occurrence of adverse events was eagerly adopted". Application of cognitive theories enables explanation of such unsafe acts, examples including the optimism bias, that everything will go right despite risks being taken, the overconfidence barrier, and the planning fallacy, which results in optimistic predictions about how long a task will take (Baron et al 2006) which can result in cutting corners and risk taking when deadlines approach. More generally, Kletz (2001) suggested that most unsafe acts were the result of a moment of forgetfulness or aberration, others the result of errors of judgement, which can also be traced back to inadequate training or supervision. Within the construction industry, Rawlinson and Farrell (2010) observe that a high tolerance to risk taking is evident, allowing intentional unsafe acts to form part of everyday site life.

A combined approach is to make technology failsafe so unsafe acts cannot lead to an accident, rather than educate workers through training programmes (Swuste et al 2014), however this is highly problematic within the construction industry, given the nature of the work. Indeed, the continuing development of technology within the workplace has led to increasing complexity and coupling between tasks and activities, therefore interactions cannot necessarily be fully planned, understood or anticipated (Leveson 2004). This is particularly relevant when many different subcontractors and long supply chains create complex relationships on sites, which itself has been found to have negative effects on safety (Manu et al 2010). Although single failure prevention is often built in to processes and equipment, this means that in practice accidents have shifted to more complicated occurrences with two or more cumulative failures, which are harder to predict and therefore harder to prevent. (Hollnagel 2004:3).

These ideas of organisational failure (Hollnagel 2004; Hovden et al 2010) and systemic safety (Dekker 2006) bring together unsafe acts and conditions. Unsafe acts have become a symptom of deeper latent problems within projects or organisations, the management system creating situations, or rather unsafe conditions that can encourage or even force human errors within certain contexts (Perrow 1999; Dekker 2006). As Whittingham (2004:34) states, most violations (unsafe acts) also have a systemic underlying cause that effectively 'encourages' them. For instance, competitive tendering for work winning (Morton and Ross 2008); and bonus and payment schemes that encourage speed and risk taking behaviours (Fellows et al 2002; Spanswick 2007) have both been highlighted as unsafe conditions, or latent safety defects, in industry operations. However, as Whittingam (2004) argues, organisations are often unwilling to look too closely at the system faults which caused the error, and would rather focus on the individual who caused it; emphasising the unsafe act rather than the systemic cause.

On construction sites, where the workplace is subject to continual changes, different resources, poor working conditions, tough environments and complex co-ordination of different trades and subcontractors (Pinto et al 2011), performance variability can be argued to be a necessity, therefore to isolate and label unsafe acts within such (potentially unsafe) conditions seems incongruous. However, this has not stopped continued focus on unsafe acts, embedded as they are in the historical language of safety. Indeed, both acts and conditions, independently and combined in systems thinking, still hold significant influence on the way accidents, incidents and near misses are investigated both academically and in practice.

The Influences of Accident and Incident Investigation

Statistics form one of the most prominent safety indicators of an industry, providing 'evidence' of safety management in practice. Accident statistics are themselves lagging indicators (Hinze et al 2013), and learning from past events is a key process for understanding why accidents occur on sites and how future performance can be improved (Manu et al 2010). Yet investigations of accident causality have developed highly complex, and at times rather unfathomable, approaches to investigating incidents from a variety of underlying theories and approaches. Indeed, Grabowski et al noted the panoply of approaches, and that there have been " … few efforts to harmonise or synthesise the models and methods" (2009, p1187), resulting in an incoherent body of work. The accident process itself has also seen development from linear, causal models, which suggest accidents are simply the sequential result of technical factors, human error or organisational problems (Hovden et al 2010), to more complex, integrated approaches. As Grabowski et al (2009) note, whilst some accidents will be the result of immediate causes, cascading through an error chain, others are much more complex with non-linear interdependencies, drawing on systems thinking for their theoretical foundation.

One of the main goals of accident investigation has been the identification of the 'root cause', and consequently the apportioning of blame (Whittingham 2004). Accidents are seen as evidence of error or failure, through either an unsafe act or the emergence of an unsafe condition, and therefore accident investigation becomes the quest to identify the responsible individual behind the error (Dekker 2011). It can be argued that this has perpetuated 'human error' as a prominent causal factor in accidents (Whittingham 2004), as the cause becomes easily identifiable as one of Reason's (1990) rule, skill and knowledge-based errors or occasional or routine violations. Yet the quest for root causes has been challenged on a variety of levels, not least the potential for over-simplification (Grabowski et al 2009). Kletz (2001) suggested that root cause has an air of finality about it, not always helpful, given that the cause of many construction injuries is actually gravity. Hollnagel (2004) suggested that causes are not sought simply for learning, but from desires for certainty, and the notion we gain knowledge that can be used in future accident prevention.

Systemic, management and organisational factors have also been identified and incorporated into accident thinking. For example, Hollnagel (2004) proposed a Functional Resonance Accident Model (FRAM) based on the concepts of emergence.

Ferjencik (2011) discussed the notions of singular causality, general causality, contextual factors, contributory factors and causal factors in the development of an Integrated Procedure of Incident Cause Analysis (IPICA). Leveson (2004:257) went further than organisational boundaries in suggesting a general form of a model of socio-technical control which also acknowledges the influences of legislation, regulations, certifications, and law.

From a practical perspective, this shift to systemic and organisational thinking has added considerable complexity to the process of accident and incident investigation. Although it is arguable that a contextual understanding of an accident is a vital part of its investigation, in order to appreciate the social and technical systems that surrounded it (Leveson 2004) and enable the development of explanations, rather than isolated root causes (Hollnagel 2004), it has been questioned whether they have provided a utilisable fit with the realities of the modern construction workplace (Hovden et al 2010). Who, one might ask, are the beneficiaries of these theories? Does the work of the construction safety inspector become easier and more effective through detailed knowledge of an emergence based accident causality model? Can a construction worker amend their behaviour through appreciating the difference between singular and general causality? While the authors don't claim to know the answers to these questions, experience suggests that there is the potential for the level of detail and the interactions of these details to develop incoherence and impracticality, as they increase in numbers and interrelationships. Hovden et al (2010) suggest that this increasing complexity is incompatible within traditional linear accident models and whether new approaches are needed , exploring non-linear perspectives (Ferjencik 2011), although, as before, this may raise its own problems, as the representations and communication of such approaches may prove too complex to practically deliver.

The uptake of more complicated approaches to investigation has been limited, or only utilised when serious incidents, such as fatalities, occur. The need for investigation to support learning, the human desire for categorisation and management, and the desire to apportion blame where necessary, has arguably resulted in the reliance on two fundamental root causes previously discussed: unsafe act and unsafe conditions. Nevertheless, in reflecting on the practicalities and realities of the construction workplace, rather than seeking complexity it is perhaps this basic approach that should be empirically explored to ascertain its benefits and limitations, whilst enabling consideration of the relationships between these two root causes.

Safety Observation Reporting

The cataloguing of safety situations, whether tagged as Safety Observation Reports (SORs), Near-Miss Reporting, Incident reporting etc., often stems from the desire to measure the safety 'status' of a project. They allow the production of statistics that are often proudly proclaimed at the entrance to projects, that announce the number of days or hours worked since the last accident and allow contractors to measure themselves against industry metrics. They also of course, as Hinze et al (2013) acknowledge, provide a leading indicator of safety performance

In other contexts, however, safety observations can allow an understanding of good and poor practice on projects. Such Safety Observation Programmes not only provide a pure statistic of leading or lagging safety performance but attempt the gathering of richer and perhaps more nuanced descriptions of both safety and also of unsafety that can lead to better interventions. Unfortunately, as Hallowell et al (2013) report, the potential benefits of proactive safety control is not well explored in the literature.

Methods

Between March 2013 and July 2014, 3,956 safety observation reports were collected from a large UK infrastructure construction project (approximate value £800M). For this dataset any manager or foreman was able to enter details in to an online system for the attention of the safety department. The person entering the report categorised it initially as a type of 'observation', either an 'Unsafe Act' or an 'Unsafe Condition' or as an example of 'Good Practice', and subsequently this observation was allocated to one of 27 different work 'categories'. A project safety advisor 'checked' this categorisation, and could amend it if necessary, potentially dismissing it as a non-safety issue, or authorising it for further action. The data used in this analysis is therefore the verbatim reports created by project personnel and was not gathered by the researchers.

A mixed methods approach has been used with these data. Quantitative analysis was carried out to initially determine the allocation of observations, and then to establish the relative quantifications of the ascribed categories beneath them. While a full content analysis of all the safety observations would reveal more about the actual practices and nature of activities that resulted in the safety report, it is beyond the scope of this paper. Therefore a qualitative approach was made to three categories, considered a purposive sample, which could then be examined in depth, utilising content analysis (Tonkiss 2004) to develop a taxonomy of the data. A taxonomy can reveal the principles underlying a classification, for example Garrett and Teizer (2009) provided a taxonomy for human error awareness in construction safety. Repeated passes of the data enabled the researchers to explore the data itself and also undertake a process of re-framing, exploring the potential for alternative categorisations than those originally made, through the lens of the literature.

Findings and Analysis

Quantitative Analysis

Of the 3,956 safety observation reports, 2,128 were categorised as unsafe conditions, 697 as unsafe acts and 1,131 as good practice. Here only 'unsafety' is considered and therefore the 'good practice' observations were removed from the dataset, resulting in 2,825 records. With just over 75% of the observations considered to be unsafe conditions these data can be considered surprising – they imply that the majority of unsafe incidents are derived from situations that are not influenced by human actions. However, this may also be a reflection of the difficulties of observing fluid and momentary acts when compared to static and unchanging conditions.

A fuller picture of the dataset and of the range of categories to which the reports had been ascribed can be found in Figure 1, which presents graphically the range of categories as assigned beneath the observations of unsafe acts and unsafe conditions.

In almost all categories it can be seen that the number of unsafe conditions exceeds the number of unsafe acts, with the exception of 'behaviour'. The inclusion of this category in itself is interesting – it is neither a work type (such as excavations or lifting) nor an organisational function (such as permits, PPE or welfare). That there are any 'unsafe conditions' that can be attributed to behaviour is also interesting and the data overall suggests either misunderstanding in the categorisation of the safety observations, or is the manifestation of the complexities of incident reporting when limited to just categorisations.

[Figure 1: Categorisation of Unsafe Acts and Unsafe Conditions]

Qualitative Analysis

In order to further explore the data, and these apparent inconsistencies, three of the categories were explored to investigate the precursor paths to unsafe acts and unsafe conditions. Initially considered was the "Behaviour" category, with a further analysis of the "Hot Works" and the "Work at Height" categories. All data are extracted from the wider dataset with a 114, 22 and 298 records respectively analysed, a total of n=434 records. To ensure findings were not restricted to just the initial 'behavioural' categorisation data, and to attempt to validate the conclusions, taxonomies were also prepared for two further categories. The 'Hot Works' and the 'Work at Height' category were chosen in order to represent different physical environments, to represent a wider range of observations and, through 'Work at Height', to investigate one of the most prevalent sources of injury in construction, which presumably suggests one of the most common forms of unsafety.

Behaviour Category

The first to be considered was the "Behaviour" category, chosen as this appeared to the authors as an unusual tag for a category. All of the other categories were areas of the project, either physical (e.g. "Excavations") or process (e.g. "Traffic

Management") whereas Behaviour is less of a work area and more of a human action. The process of this analysis was revealing. In the initial dataset, 48 observations were recorded as unsafe conditions but many of these did not fall under a definition of situations that were unsafe through non-immediate human means. For example, one report suggested that "Welder welding without screen in internal stair" was reported as an unsafe condition, presumably because the correct equipment was not present, but in the researchers' interpretation the lack of a screen in a particular area should not be the immediate focus; rather the fact that the welder chose to continue welding without a screen present is itself poor human judgement and thus an unsafe act. This consideration of 'human means' was used as a benchmark for classification, while at the same time acknowledging it is arguable that any classification process is inherently subject to interpretation, as demonstrated by the data explored here: overall, of the 48 initial such observations only 5 remained as such following the re-framing process; 90% were changed by the researchers. This finding illustrates the complexities involved in deciding at what point an act, or number of acts, eventually emerges into a condition; these decisions are inherently subjective.

However, those observations that remained 'unsafe conditions' following the re-framing process were still supported by the sub-categorisation of behaviour. Here, and to further develop the previous argument, the underlying premise was that an act had initiated the condition, although the line between them had been drawn at the level of the categorisation rather than the observation. For example, the observation that "road pins for gulley setting out have no protection either place caps or remove pins", can be related to behaviour, or rather the omission of the behaviour to place caps on the pins, but it could also relate specifically to excavation works. Although this analysis arguably supports more complex, non-linear and emergent approaches to analysing safety incidents, given the reliance on acts and conditions it can be suggested that what would actually be of greater utility would be a clearly defined and shared understanding of the 'line' between acts and consequentially emergent conditions, integrating this concept of behaviour within it.

Another notable aspect of these data, revealed by the analytical process, was the prominence of finger pointing or blaming individuals for their behaviour. For example “Safety rep parking vehicle in live traffic route to speak to his supervisor”; “Security guard not using walkways, challenged and re-routed to walkway” are clearly identifying individuals with some level of authority. While many unsafe act observations report simply the behaviour of an unidentified individual, 37% directly identify the individual by name or by the company they work for or by the registration number of their vehicle. Such data strongly indicates highly complex social and organisational issues at play that have seeped into the safety observation process, in part those who create and enforce the policies are readily punished by others for their violation. Even where individuals are not named, the desire to lay blame can be found within the data, a fundamental need in incident reporting as suggested by Whittingham (2004) and Dekker (2011).

[Figure 2: A taxonomy of the Behaviour category of safety observations]

The prepared taxonomy itself, seen in graphical form in Figure 2, was also of interest; both behavioural acts and conditions easily assigned to either ‘policy’, ‘procedural’ or ‘equipment’ categorisations, suggesting that a more useful assignment could be made at a more detailed level within the data, rather than the traditional act/condition dichotomy. As the taxonomy developed, ‘deliberate’ and ‘inadvertent’ also emerged as key categorisations, ‘deliberate’ further supported by notions of ‘shortcuts’ and deliberate violations of procedure. It should be noted that this taxonomy, and those presented later, are intended to be examples of the nature of unsafety antecedents and are not intended as a generalisation for practice use.

Hot Works Category

To ensure these findings were not restricted to just the ‘behavioural’ categorisation data, and to attempt to validate the conclusions, taxonomies were also prepared for two further categories. The ‘Hot Works’ and the ‘Work at Height’ category were chosen in order to represent different physical environments, to represent a wider range of observations and, through ‘Work at Height’, to investigate one of the most prevalent sources of injury in construction, which presumably suggests one of the most common forms of unsafety.

The 'Hot Works' category was a much smaller sub-set of the data (n = 22 reports that were either unsafe act or unsafe condition) than seen in 'Behaviour', yet the same taxonomy categories emerged from these data. The only category present in hot works but not in behaviour was 'missing equipment'. This is itself of interest, as it could be suggested that equipment has developed beyond its inherent unsafety, the initial causes behind historical concerns around unsafe conditions (Hollnagel 2014), and rather it is unsafe acts involving this equipment that have become more relevant to practice. The taxonomy for hot works can be seen in Figure 3.

[Figure 3: A taxonomy of the Hot Works category of safety observations]

In the preparatory process of this second taxonomy, similar observations were made as for the behaviour category. Reports again appeared to be incorrectly categorised as unsafe condition when could be more appropriately labelled unsafe act (50% were changed) and those that identified individuals or companies and could be considered 'blame reports' (27%), though both were not to the same extent as for 'behaviour'.

Work at Height Category

A final investigation was undertaken on a category with a significantly higher number of observations (n=298). Once again each observation record was considered in terms of the type of unsafety identified by the initial observer and then, if necessary, this was reframed by the researchers. In total it was decided to change 92 records, or 31%, all but three of these being changes from 'Unsafe Condition' to 'Unsafe Act'. For example, one observation recorded that "Modifications have been carried out to crane suspended access basket i.e. extra section welded to front" should be categorised as an Unsafe Condition but to the researchers this was a clear Unsafe Act. As before, the categorisation can be seen as a reflection of the 'distance' between the Unsafe Condition recorded and the Unsafe Act that led to that condition. The reframing of unsafety resulted in a total of 58% categorised as an Unsafe Act with the remaining 42% being Unsafe Conditions.

While almost all observations stem from an unsafe act at some point in the development of the particular example of unsafety, the decision by the researchers on which type to reframe it as came down to whether that act took place at the location of the actual unsafety. For instance, “Open edges around external jumpform” was an observation recorded as an Unsafe Condition and this category was kept as the unsafe act which led to this unsafety was assumed to have occurred some time before the jumpform was actually used. On the other hand, “Toe-Boards Missing, Installation of perimeter walkway” was initially categorised as an Unsafe Condition but was changed by the researchers as it was considered an act of unsafety occurring at the time of observation.

The graphical taxonomy for ‘Work at Height’ is shown in Figure 4. Four levels of antecedent categorisation were applied and for the first level an attempt was made to stay with the same tags as applied to the ‘Behaviour’ and ‘Hot Works’ categories, i.e. Policies, Equipment and Procedures. Thereafter the precursors and antecedents changed slightly to reflect the nature of the ‘Work at Height’ unsafety observations, though many similarities remained.

[Figure 4: A taxonomy of the Work at Height category of safety observations]

For example, Inappropriate Equipment Use, Shortcut, Poor Practice, PPE are common to both ‘Work at Height’ and ‘Behaviour’, as are the considerations of whether the unsafety was Inadvertent or Deliberate. But many of the precursor tags are different – in general it can be seen that most tags in the ‘Work at Height’ category are physical or situational (for example, Missing Equipment, Damage/Failure, Design Issue) while those in the ‘Behaviour’ category are indeed acts of behaviour, such as Texting, Not Following Instructions or Smoking.

All three taxonomies have common elements, however, and an attempt has been made to draw out in the last or upper level of precursor categorisation an identification of the behaviour or situation that has eventually led to the observation of unsafety. In total across all three taxonomies there are seventeen separate precursors or antecedents to unsafety and it is these that we propose are the focus of interventions.

Unsafety Antecedents

The ease with which the same categorisations were identified in the preparation of both taxonomies suggest there may be a common pattern to how unsafety can be understood in terms of 'antecedents', by which we mean those situations, issues, aspects and factors of operations and activities which existed before an unsafe act or unsafe condition occurs. To bring all three taxonomies together, these categorisations have been combined within the broader considerations of time, as shown in Figure 5, which essentially 'flips' the taxonomies to reflect practice. Generally, equipment, procedures (and, to a lesser extent, policies) can be identified as the domain, decisions and triggers the antecedents which are categorised as either inadvertent or deliberate within the area of activity closest to practice, thus leading to a state of unsafety either as act or condition.

[Figure 5: The development of unsafety]

Conclusions

Through content analysis of 434 Safety Observation Reports taken from a larger dataset of nearly 4,000, a greater understanding of the nature of unsafety as perceived by those undertaking construction work emerges. The process of analysis revealed both complexities and subjectivity within the reporting process, and in certain case an underlying desire to apportion blame. This raises questions of the motivation for creating reports; to point fingers, particularly at those in authority, or to genuinely attempt to improve conditions. Projects and organisations undertaking safety reporting of this nature should seek to ensure this does not undermine the utility of the exercise.

The categorisation of unsafe acts and unsafe conditions was found to be highly subjective, and likely dependent first on a robust definition of what constitutes an 'act' and what a 'condition'; and secondly on individuals' interpretation of this definition. This was also apparent during the analysis, where the researchers' reallocation of categorisations was of course to some extent itself inevitability subjective, something which adds inherent and inevitable complexity to this type of research. Many reported unsafe conditions were deemed by the researchers to actually be unsafe acts. In some ways the initial categorisation by site staff is contrary to the conclusions of Whittingham (2004), who argues that organisations would rather focus on the error of the individual. Yet the contextual descriptions of each observation challenge this further – while many clearly indicate human error, most unsafe acts were categorised as systemic conditions. If such labels are to be used then clearer and objective definitions are needed for consistency of reporting, to mitigate the subjective nature of the process.

Preparation of taxonomies on three subsets of the overall data enabled a broader and more detailed understanding of how unsafety develops, and also that this development was very similar for both acts and conditions. Rather than being considered as two ends of a single spectrum, they are perhaps instead two artificial constructs superimposed on a development of unsafety, that has roots in decisions made either consciously or unconsciously; deliberately or inadvertently. It is suggested that further research explore these antecedents in practice, including the utility of its application to existing reporting processes to ensure its ability to enhance, rather than over-complicate, existing industry reporting procedures.

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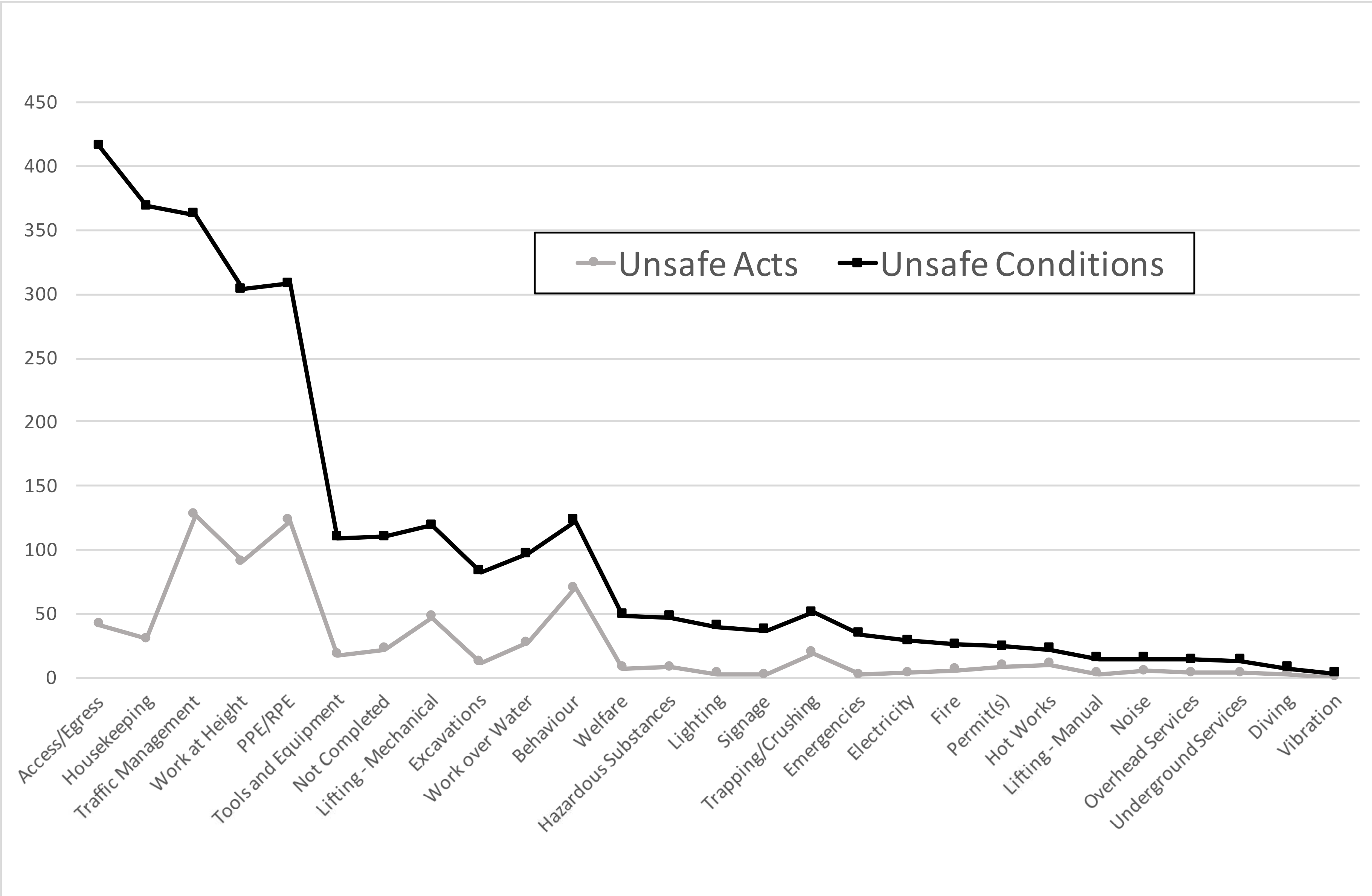
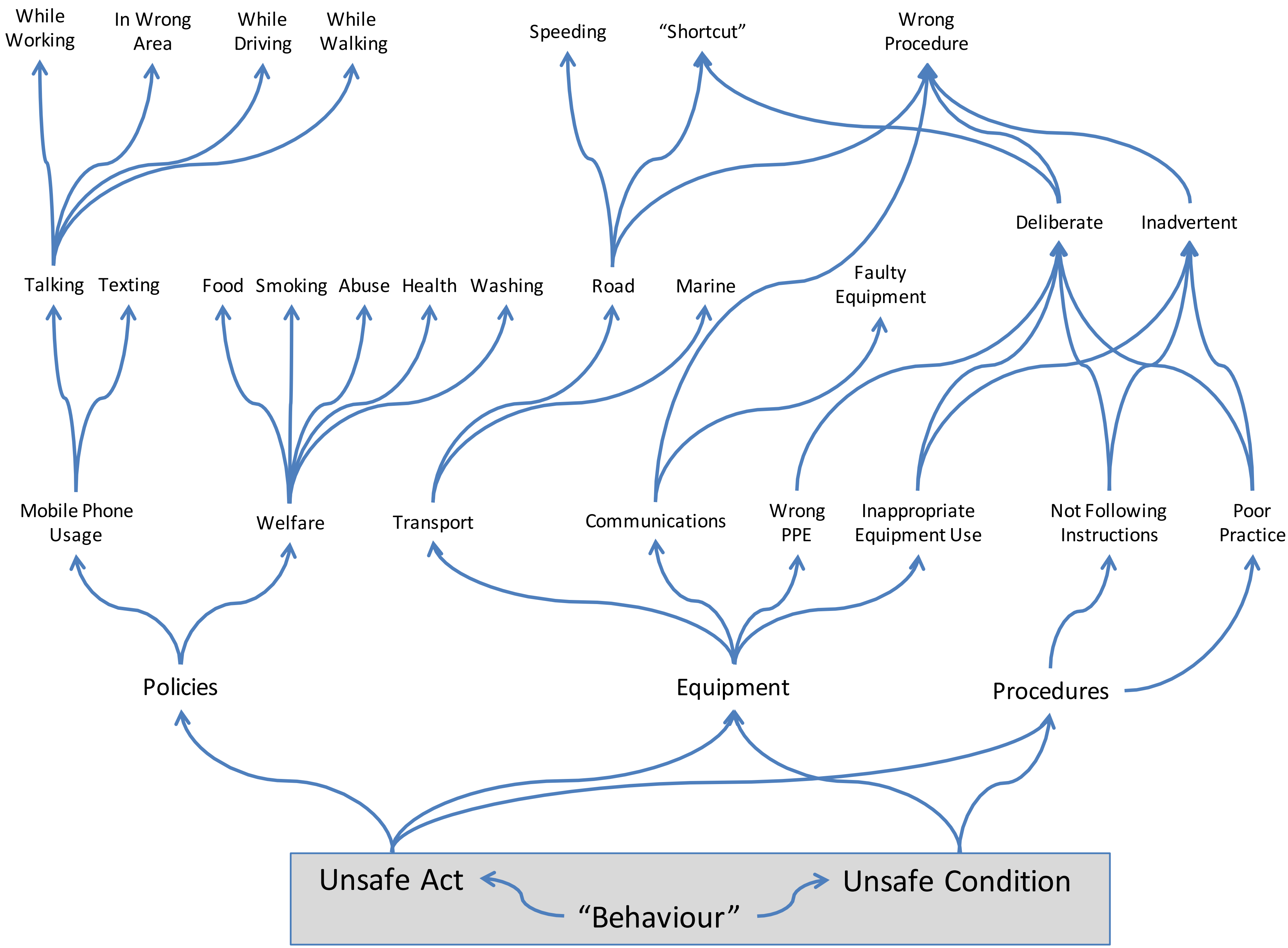
Figure 1



450
400
350
300
250
200
150
100
50
0
Unsafe Acts
Unsafe Conditions
Access/Egress
Housekeeping
Traffic Management
Work at Height
PPE/RPE
Tools and Equipment
Not Completed
Lifting - Mechanical
Excavations
Work over Water
Behaviour
Welfare
Hazardous Substances
Lighting
Signage
Trapping/Crushing
Emergencies
Electricity
Fire
Permit(s)
Hot Works
Lifting - Manual
Noise
Overhead Services
Underground Services
Diving
Vibration

Figure 2



While Working
In Wrong Area
While Driving
While Walking
Speeding
"Shortcut"
Wrong Procedure
Deliberate
Inadvertent
Talking
Texting
Food
Smoking
Abuse
Health
Washing
Road
Marine
Faulty Equipment
Mobile Phone Usage
Welfare
Transport
Communications
Wrong PPE
Inappropriate Equipment Use
Not Following Instructions
Poor Practice
Policies
Equipment
Procedures
Unsafe Act
"Behaviour"
Unsafe Condition

Figure 3

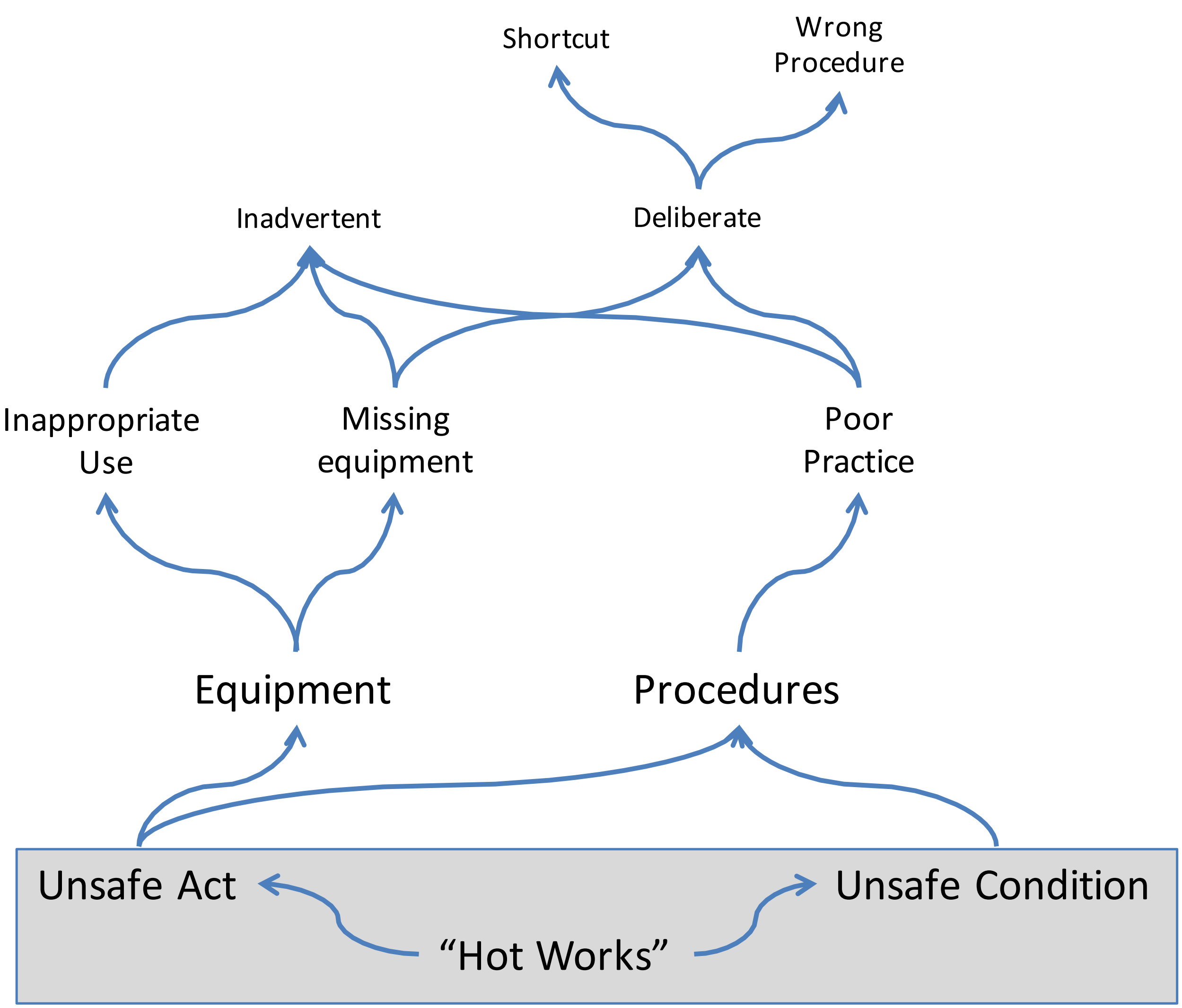
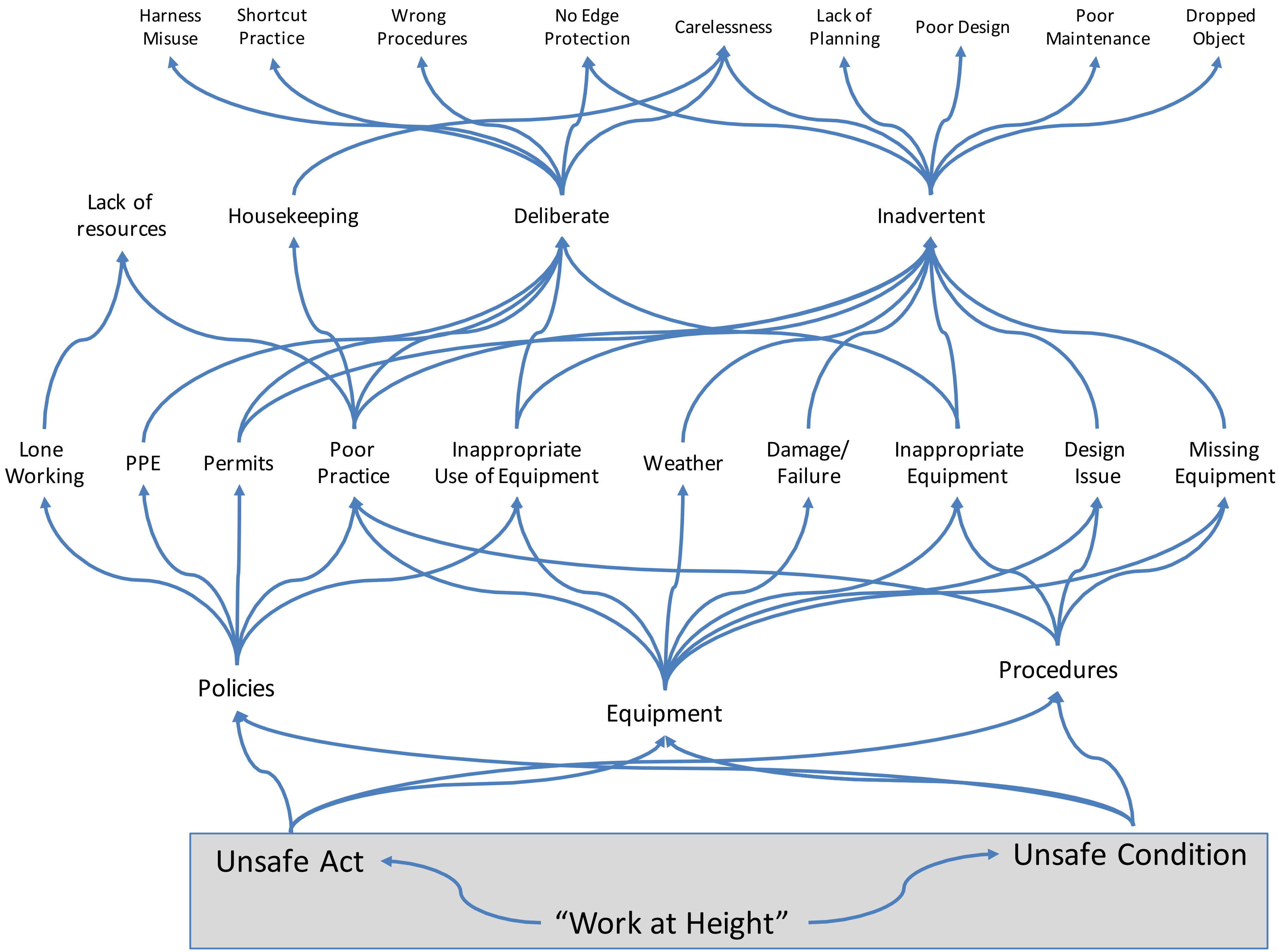
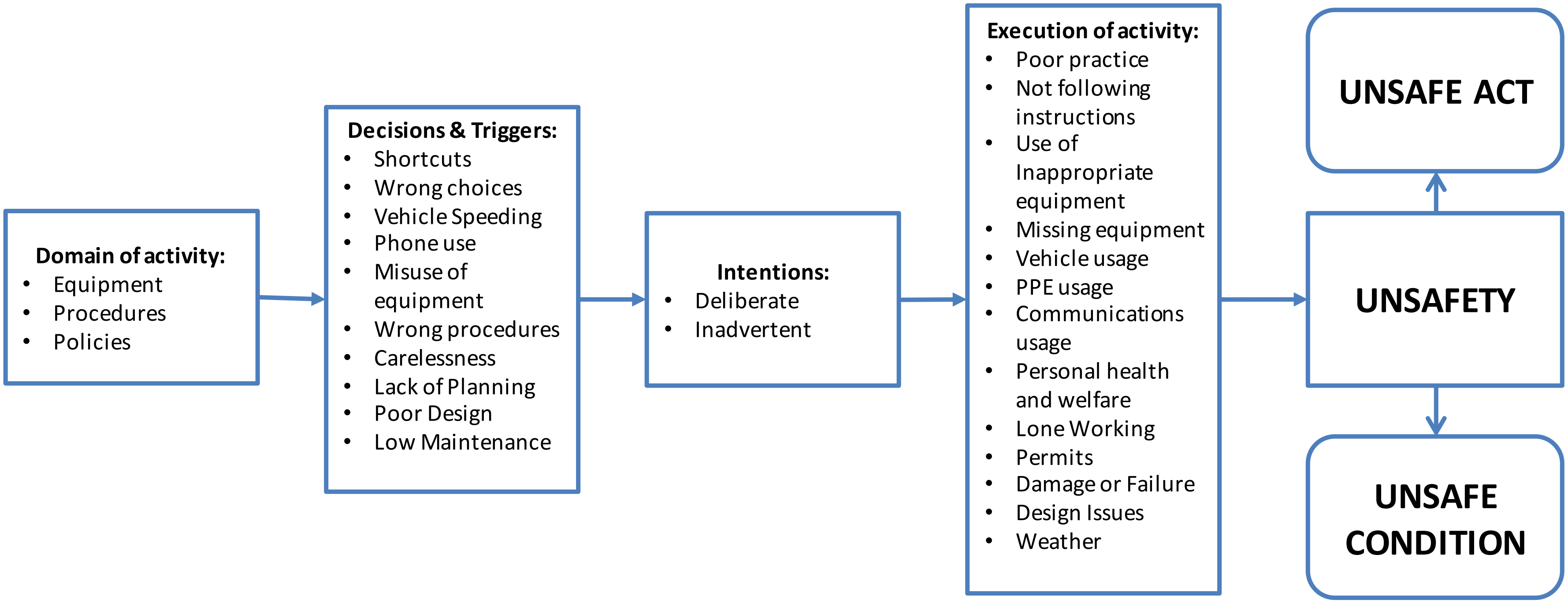

Shortcut
Wrong Procedure
Inadvertent
Deliberate
Inappropriate Use
Missing equipment
Poor Practice
Equipment
Procedures
Unsafe Act
Unsafe Condition
"Hot Works"

Figure 4



Harness Misuse
Shortcut Practice
Wrong Procedures
No Edge Protection
Carelessness
Lack of Planning
Poor Design
Poor Maintenance
Dropped Object
Lack of resources
Housekeeping
Deliberate
Inadvertent
Lone Working
PPE
Permits
Poor Practice
Inappropriate Use of Equipment
Weather
Damage/ Failure
Inappropriate Equipment
Design Issue
Missing Equipment
Policies
Equipment
Procedures
Unsafe Act
Unsafe Condition
"Work at Height"

Figure 5



Domain of activity:
Equipment
Procedures
Policies
Decisions & Triggers:
Shortcuts
Wrong choices
Vehicle Speeding
Phone use
Misuse of equipment
Wrong procedures
Carelessness
Lack of Planning
Poor Design
Low Maintenance
Intentions:
Deliberate
Inadvertent
Execution of activity:
Poor practice
Not following instructions
Use of Inappropriate equipment
Missing equipment
Vehicle usage
PPE usage
Communications usage
Personal health and welfare
Lone Working
Permits
Damage or Failure
Design Issues
Weather
UNSAFE ACT
UNSAFETY
UNSAFE CONDITION